2016 Design Training Expo

Retention Pond Grading in Civil 3D 2016

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FDOT

What will be covered in this session

- Create and Setup a Pond Design File
- Explain Grading Criteria and Grading Groups
- Explain Grading Feature Lines and Sites
- Using the Grading Tools design a Retention Pond
- Create a Stage Storage Table

Creating a Pond Design File

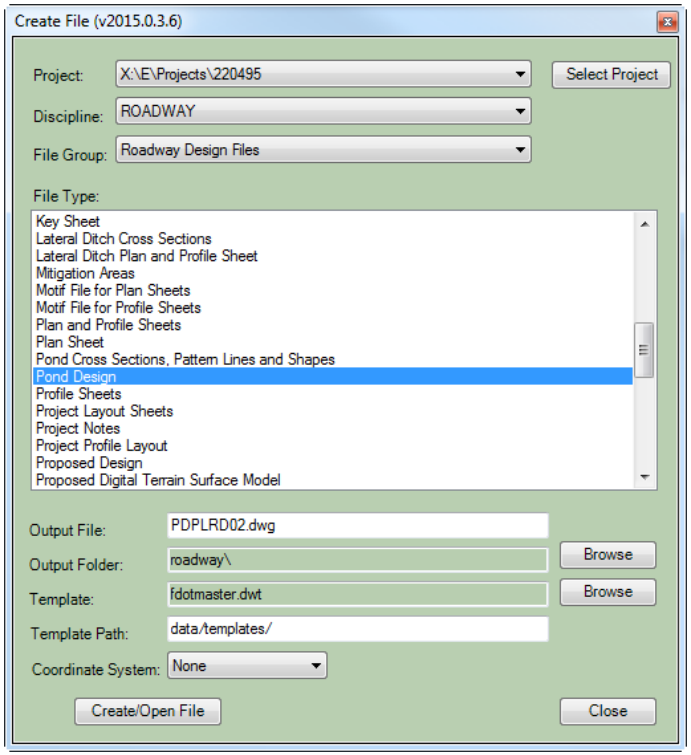
Open Civil 3D 2016 through the FDOT State Kit Shortcut

The image above shows the desktop shortcut and the pinned to taskbar shortcut

Make sure you set your Data Shortcut folder to your desired project before running the Create File Application. The reason for this is to automatically set the coordinate zone in the new file.

Creating a Pond Design File

Click on the FDOT Ribbon and select the Create File Application



- **Project:** Make sure to select the actual project number
- **Discipline:** Roadway
- **File Group:** Roadway Design Files
- **File Type:** Pond Design

The Other items will auto populate such as drawing name and which template file the new drawing is being created from.

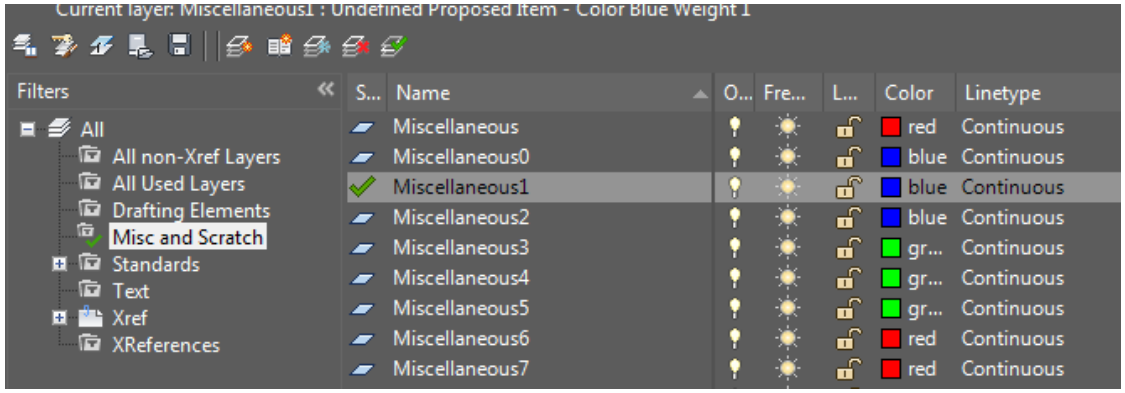
Click Create/Open to start your new drawing. When open select Close.

Preparing necessary data to start grading

The PDPLRDXX.dwg will need data referenced into it before we start our design. For Xreferences we will need the **DSGNRD** and **RWDTRD** drawing files.

For Data References we will need the Existing Surface to grade off of.

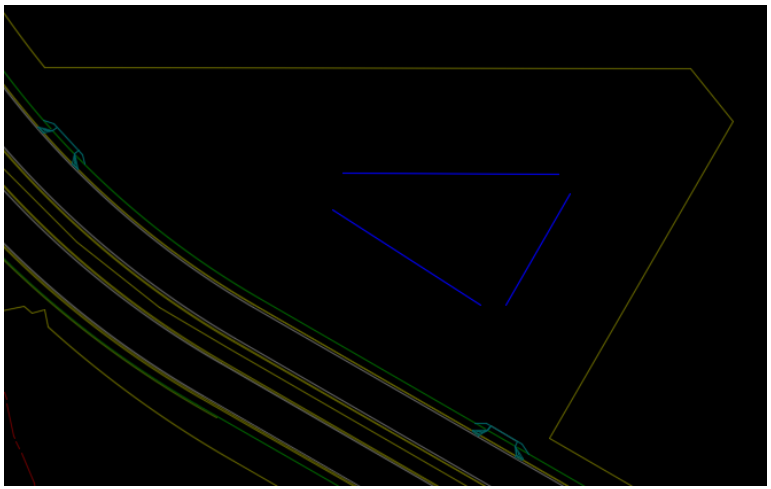
Using the built in Layer Filters click on the **Misc and Scratch** filter and select any Miscellaneous layer to make it current.



Now we can offset temporary line work from the **RWDTRD** Xref file.
Near the intersection Offset the ROW 80', this will be the bottom of the pond.

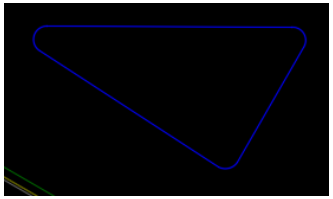
Creating a Feature Line

The drawing should look like image below.

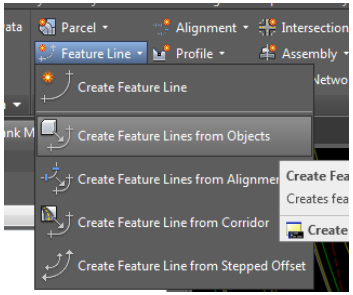


Using the AutoCAD fillet command with a radius of 10', fillet the three corners of the blue lines.

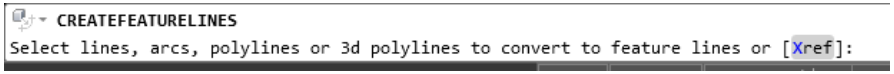
You should have a single polyline with fillets on the corners now.



On the Home Ribbon select the **Feature Line** pull down and select **Create feature Lines from Objects** Create from objects

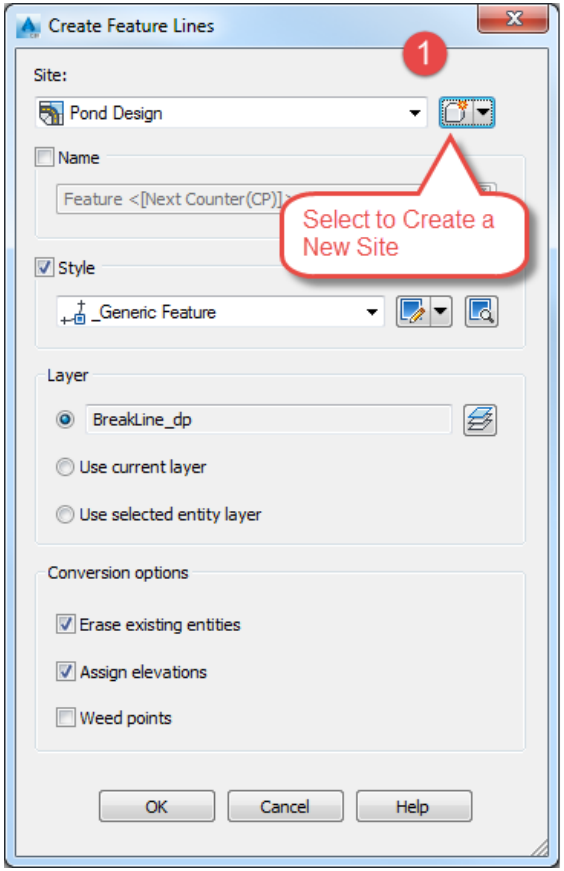


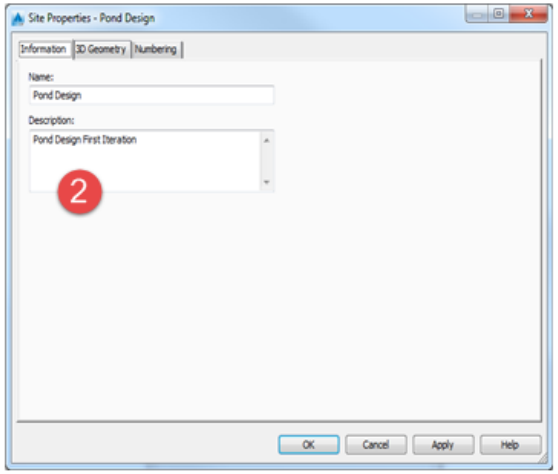
Pay attention to the command line since a lot of back and forth interaction is needed. Pick the blue polyline



Creating a Feature Line

When you select the polyline the Create Feature Lines dialog box opens





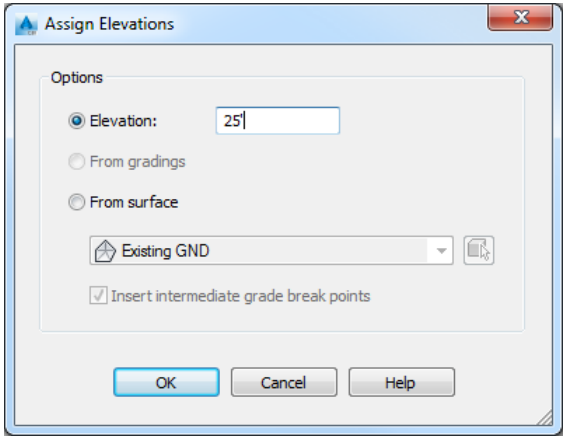
Select the New Site button to launch the New Site Dialog box. Name the new site **Pond Design** and the description Pond Design First Iteration. Select OK.

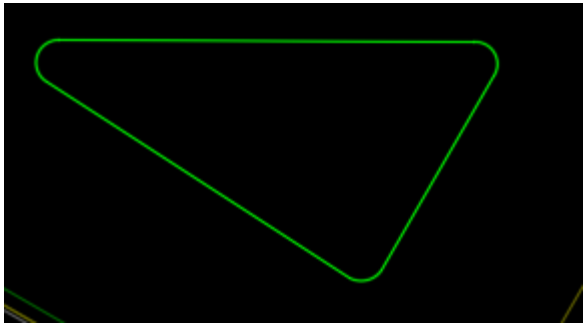
Make sure your Create Feature Lines dialog matches the diagram at left. Select OK.

Tip: You can have multiple sites for a pond grading and it they will not interact with one another. Once a final design is complete you can extract the surface to paste into the finished surface.

Creating a Feature Line

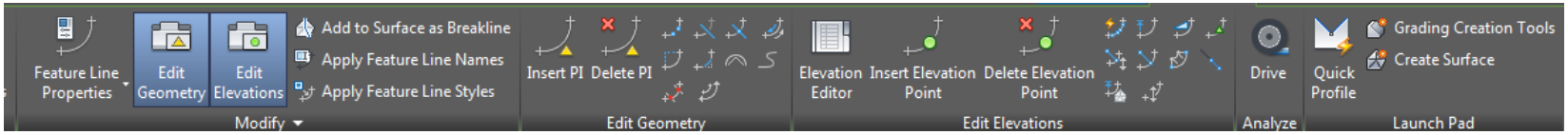
Since the Assign elevation toggle was selected in the previous box an Assign Elevations dialog box opens. Toggle on the Elevation and set it to 25’ like shown below. Select OK.





Notice the Blue polyline is erased and a Green Feature Line takes its place, that is because the erase entities was toggled on when the feature line was created.

If you select the feature line notice the contextual ribbon which is along the top with different editing tools specifically for feature lines.



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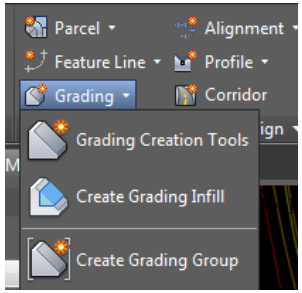
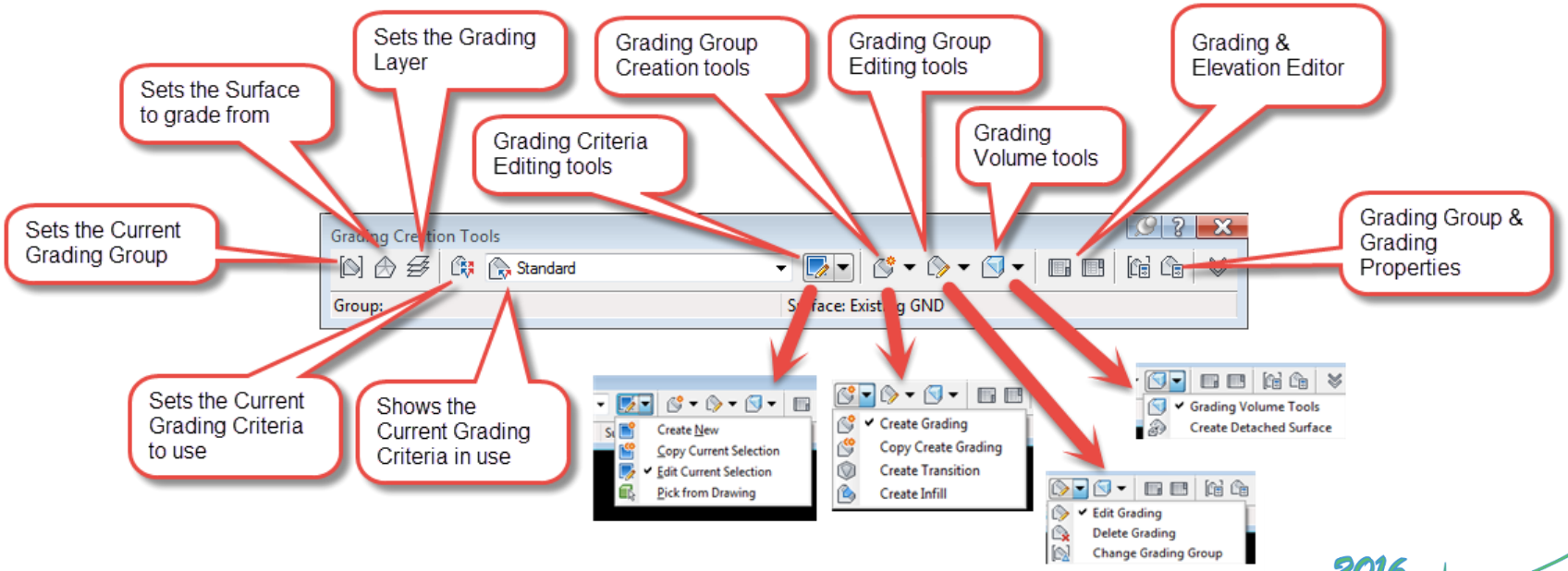
Grading Creation Toolbar

On the Home Ribbon select the grading pull-down > Grading Creation Tools



Review the image below for a description of all the grading tools that reside on the toolbar.

Tip: You can always re open this toolbar by selecting your gradings and right clicking > and select the edit options.



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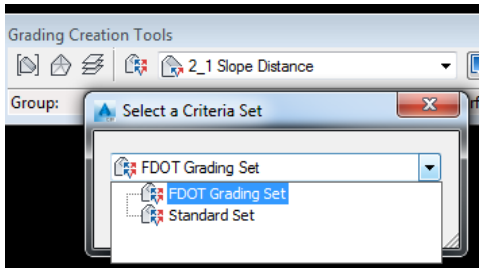
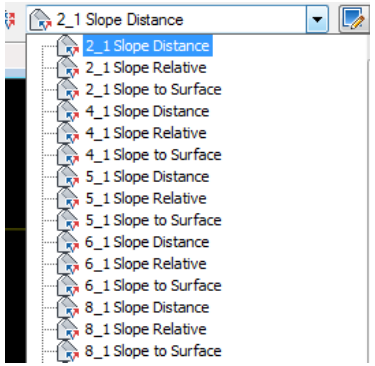
Grading Criteria & Grading Groups

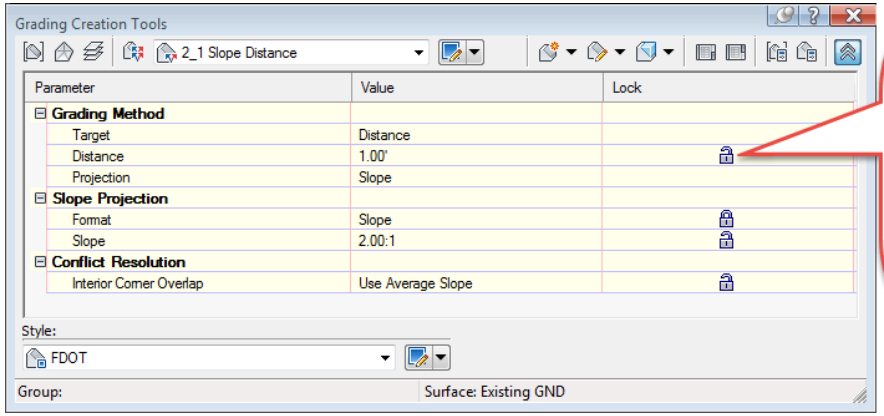
Set the Grading Criteria to the FDOT Grading Set





The Grading Criteria pull down is now populated with preset criterias that you can add to your grading group.

What are Grading Criterias?



The Lock symbols represent whether or not you need to enter user input on the command line. Meaning that in this example the user can enter in a different distance other than the default 1'. If it locked it means that value is fixed. You cad unlock and edit however.

Criterias can be set to grade at a Distance, Depth Elevation, or to a surface

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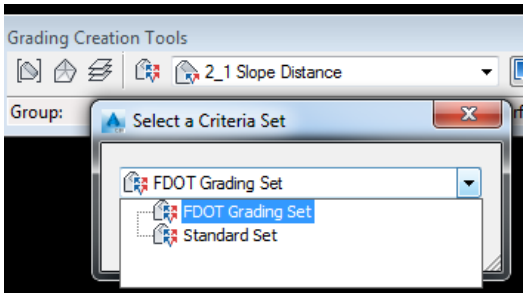
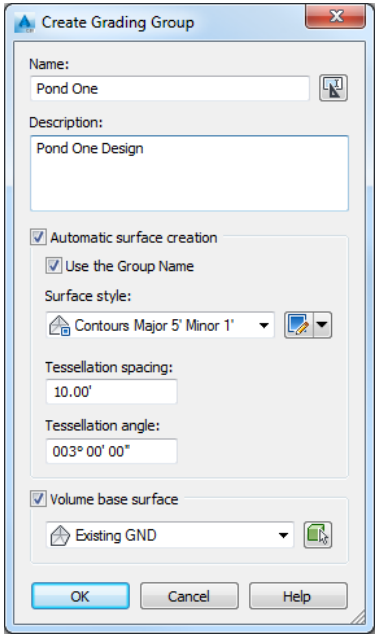
Grading Criteria & Grading Groups

Set the Grading Criteria to the FDOT Grading Set and set criteria to 6_1 Slope Relative

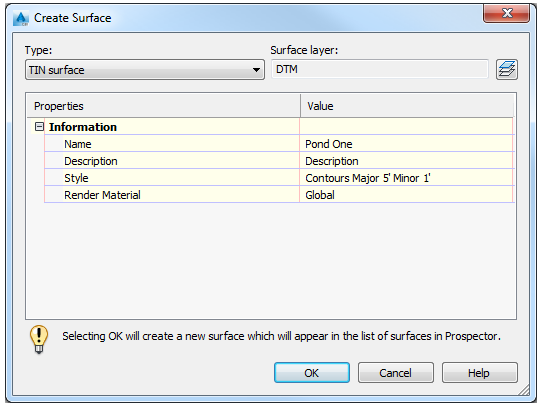


When you click on Set Grading Group  The Grading Group dialog opens



Fill in information to match the image at left.

Note that we are creating a new surface as we are grading and using a proposed surface style. We are also setting the base surface to calculate earthwork volumes from.



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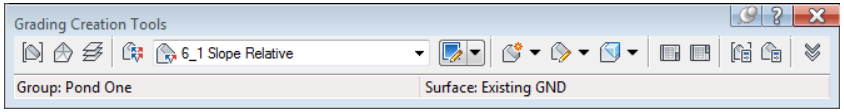
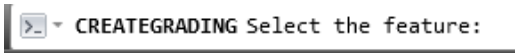
Grading Criteria & Grading Groups

Now the Grading Creation Toolbar updates to she both the current **Group** and **Surface**



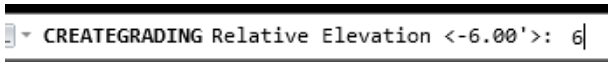
Now select the **Create Grading**  icon to start the grading process

Again pay attention to the command line for needed feedback from you. 

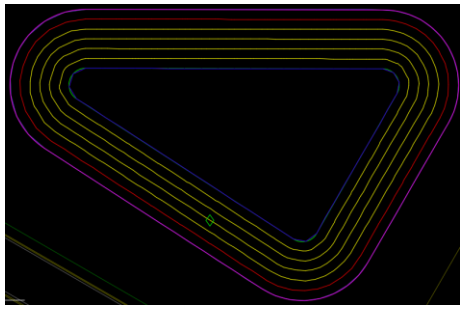
Select the Feature Line you created > Pick outside of feature line for side of grading, since the feature line will be the bottom of pond

Press enter to select yes for grading on all sides of the featureline

For Relative Elevation we want to go up 6', so enter 6. The default is going down 6'



Hit enter again and your first grading appears with the surface contours



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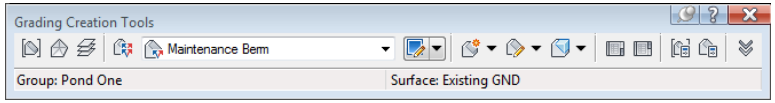
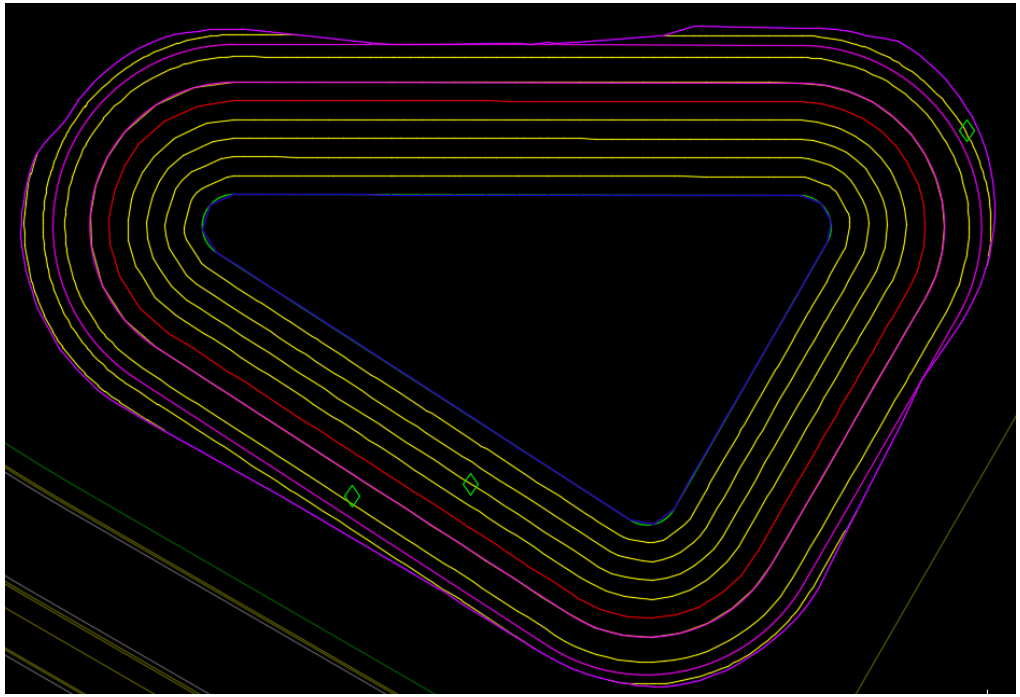
Grading Criteria & Grading Groups

Change the Criteria to Maintenance Berm and select the feature line that is at the outside (top) of the pond



Again looking at the command line make changes as needed or except the default and press enter.

Change the criteria to 6_1 Slope to Surface to tie the pond into the existing ground surface.

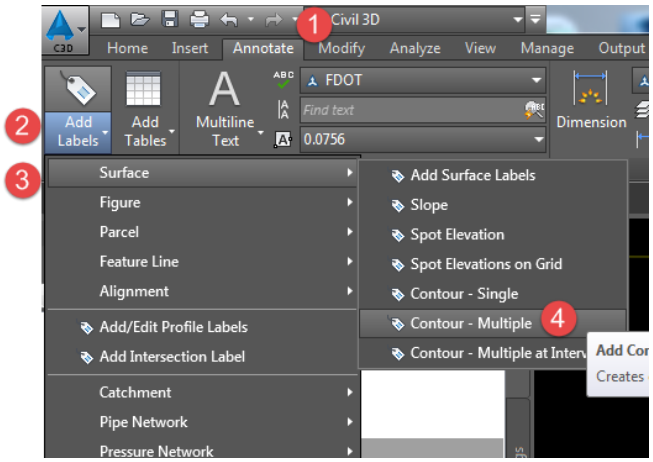


The drawing should now look like image at left.

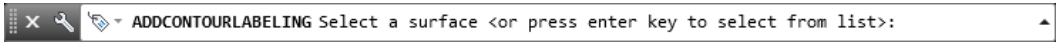
The green diamonds on the pond represent grips for each of the grading criterias. To edit an individual criteria select the grip and either right click and edit or make the selection on the contextual ribbon.

Adding Contour Labels

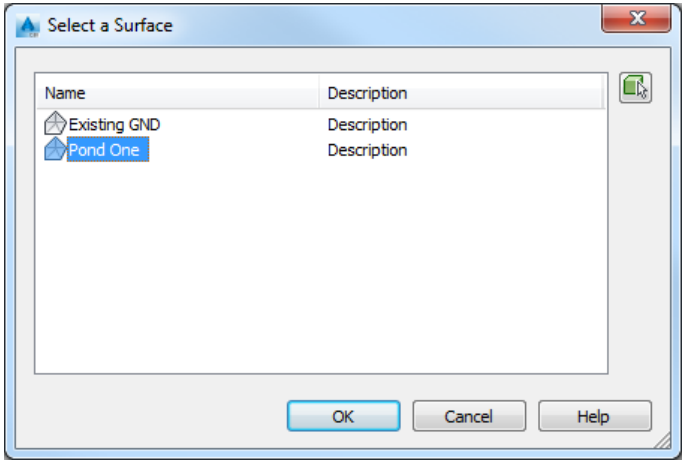
Click on the Annotate Ribbon > Add Labels > Surface > Contour - Multiple

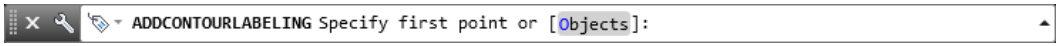


The command line now asks for the surface to label. Press Enter to choose from the list.

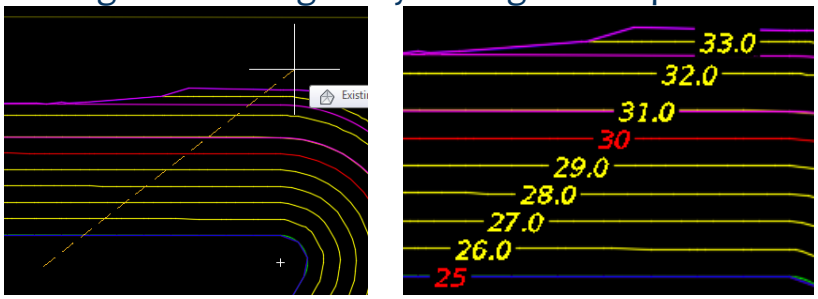


Select Pond One from the List > Press OK.





Click inside the bottom of the pond to drag the line diagonally through the top of the pond as diagram shows. Left Click and the labels are placed.



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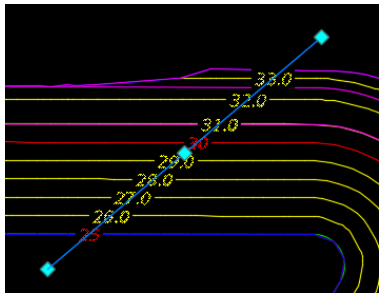
Editing Contour Labels

Clicking on a contour brings up a blue line with grips. As shown below.



You can edit the location of the labels by grip moving the line to stretch it from either end. You can even copy it to another location of the pond and the labels will place automatically.

Once you hit escape the blue line disappears and it will also not print.

Surface Contour Label Group	
Labels	
Display Contour Label Line	False
Masking	From Label Style
Display Major Contour Labels	True
Surface Contour Label Style Major	FDOT Proposed Major
Display Minor Contour Labels	True
Surface Contour Label Style Minor	FDOT Proposed Minor
Display User Contour Labels	False
Surface Contour Label Style User-de...	FDOT Existing Major
General	
True Color	ByLayer
Layer	TextElevLabel
Linetype	ByLayer
Linetype scale	1
Plot style	ByLayer
Lineweight	ByLayer
Hyperlink	
General	
Surface	Pond One

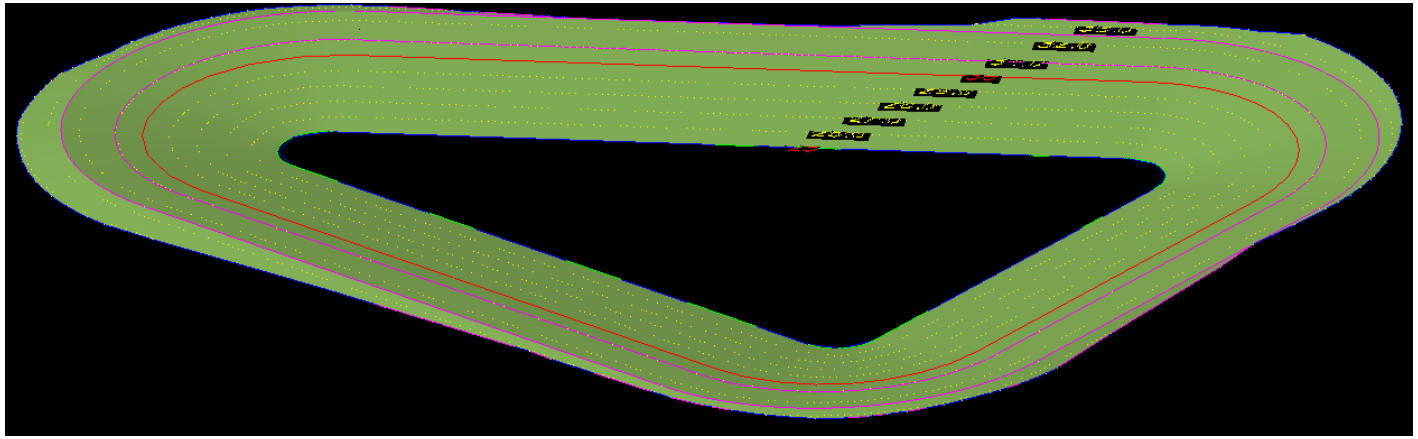
Click on a contour again > Right Click > Properties

From here you can control if the Contour Label Line is visible or not (Default is set to False Visibility)

You can also control if you want just the minor or major labels to display. You can even change the display style. The default style has a text mask on the labels to make the contour line appear broken.

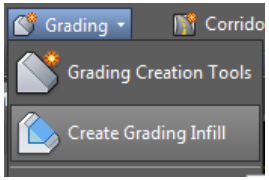
Grading Infills

Window from right to left and select the entire pond. Make sure to only get the pond in the selection window > Right Click > Object Viewer.



Rotate the pond in object viewer to view it in 3D. Notice there is a visible hole in the bottom of the pond. We need to add a grading Infill. Close Object Viewer and select the Home Ribbon.

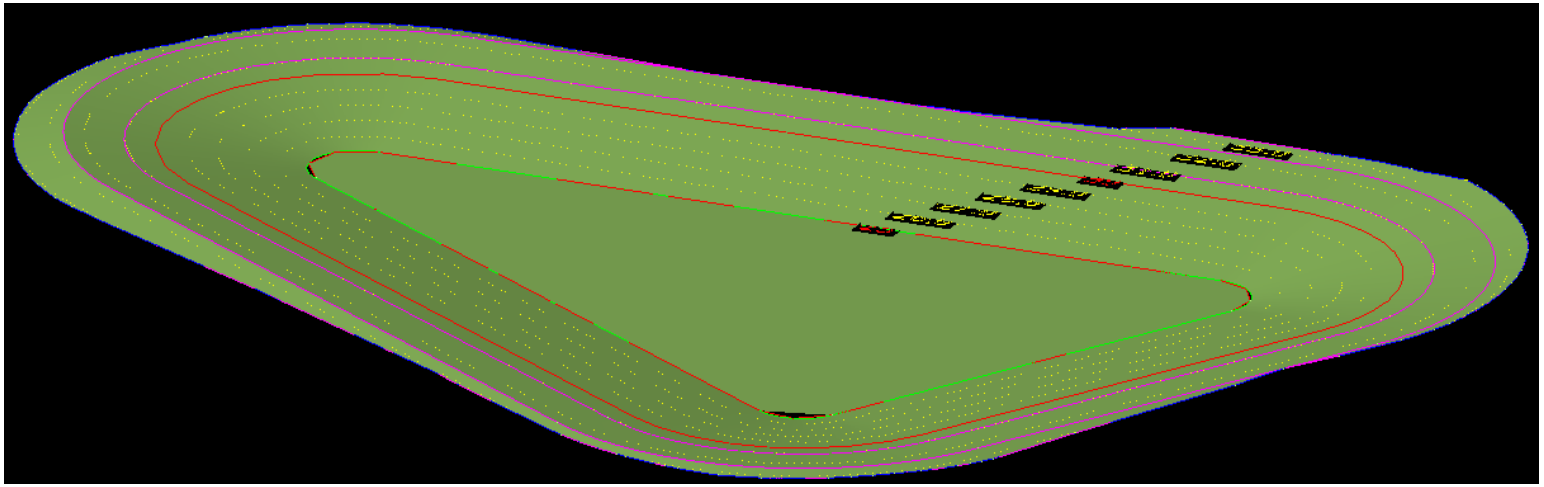
Click Grading > Create Grading Infill



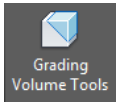
Select the Bottom of the pond > You will see the inside Feature Line Highlight > Left Click > A Green Grip is now visible in the bottom of the pond.

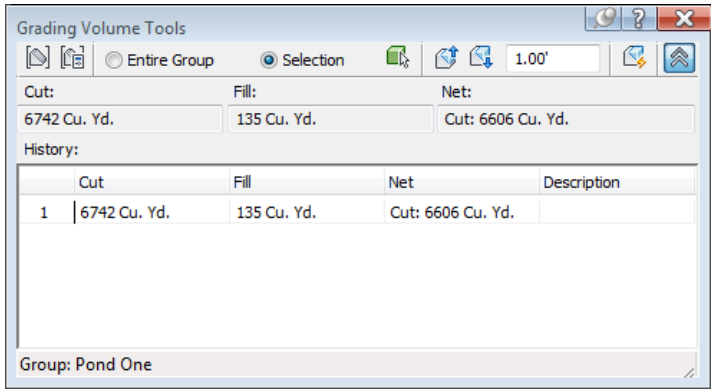
Grading Infills

Now repeat the steps previously with Object Viewer to look at the pond in 3D. The pond is now complete. Close Object Viewer.



Select any of the Green Diamond Grips and from the Contextual ribbon select Grading Volume Tools

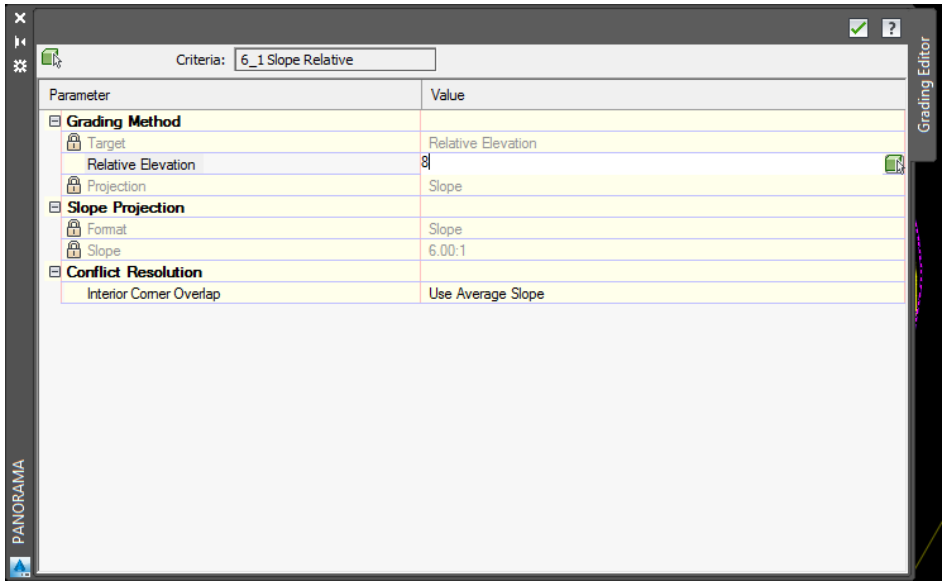




This will show you the current Earthwork Quantity for the pond. If you had different Iterations of your pond you could switch to different groups. You can also Raise or Lower the surface a set amount to update the Quantity. You can even select balance site to generate a net 0 Cut and Fill

Grading Edits

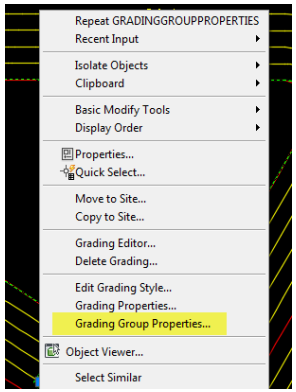
Lets say you want to change the Height of the pond to 8'. Select the Green Grip that represents the 6:1 Slope > (Right Click or Ribbon) Edit Grading > Change the 6 to 8 > Press the Green Check to close.

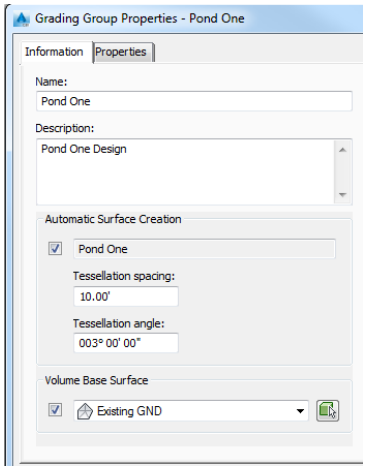


Notice how the Pond Surface updated all of the other connected gradings. Any edit or change you enter gets dynamically updated.

Grading Edits

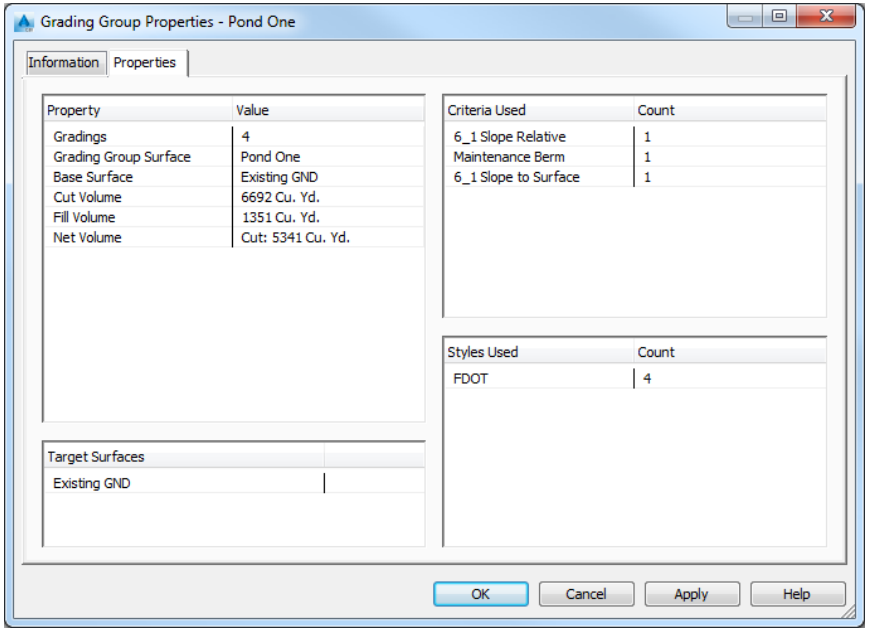
To see more Information about your design Select any Green Grip > Right Click > Grading Group Properties





The Information tab notes the name of the group and surface used.

Tip: If you forget to create a Grading without Automatically creating the surface this is where you would toggle the surface option on afterwards. The Surface dialog will open when selected.



The Properties Tab gives you information on the number of Gradings used in the group, The Criteria in the order used, The Target Surface, & the Styles in use.

The Earthwork Quantity is also displayed.

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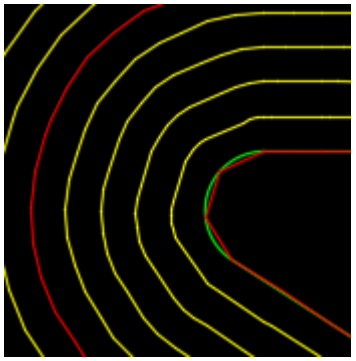
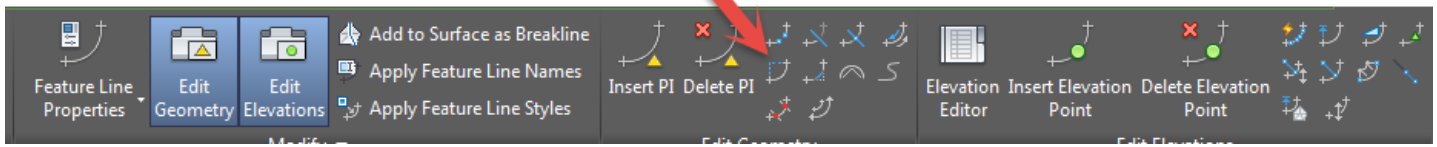
Feature Line Edits

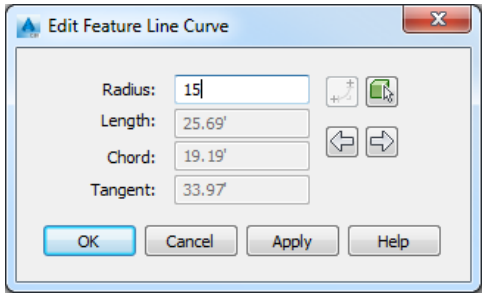
Zoom into the North Western Side of the pond as shown below. You will edit the Feature Line Radius.



Select the Green Feature Line, notice the Contextual Ribbon that appears on top.

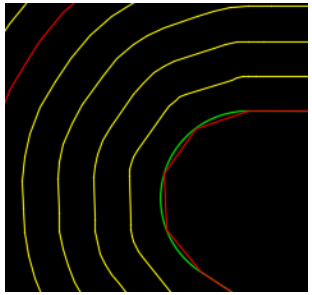
Select the Edit Curve Icon.
Tip: Hover over the icons to get a tool tip of what each function does





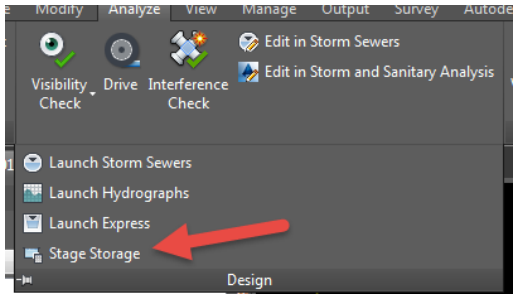
The Edit Feature Line Curve Dialog opens allowing you to change the Radius. Change it to 15. Press OK. You see the curve update and the command is still active awaiting to edit another curve.

Press Enter to Exit and the pond will update with the new radius at the bottom of the pond.



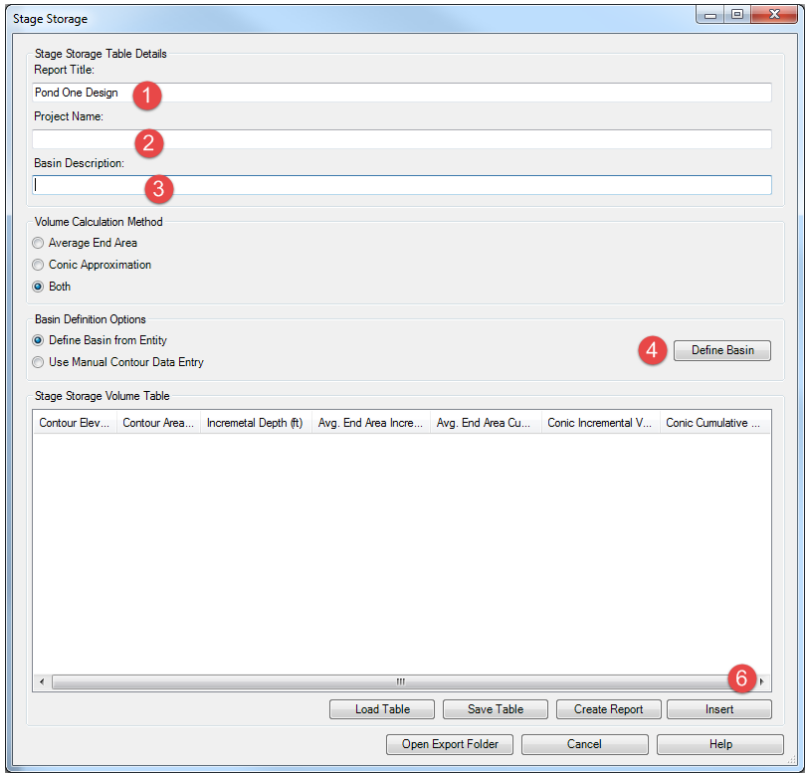
Stage Storage Table

Click on the Analyze Ribbon > Design Pull down > Stage Storage

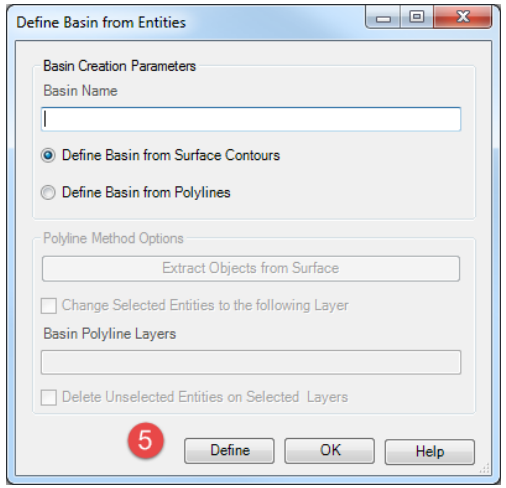


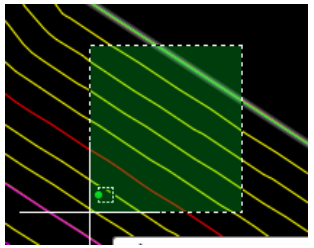
The Stage Storage Dialog box opens

Fill in the requested information and select Define Basin



The Define Basin from Entities Dialog opens allowing you to define the basin from Surface Contours or Polylines with Elevations. Window from Right to Left to include the contours you want to include.





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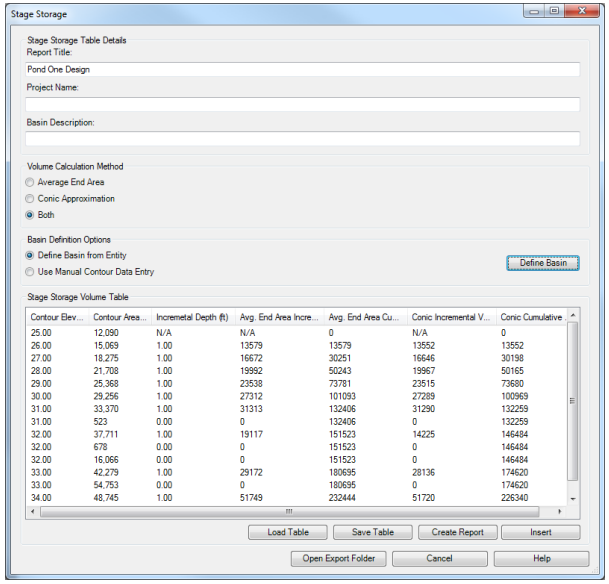
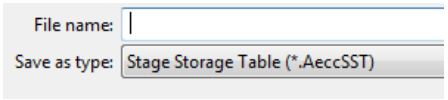
Stage Storage Table

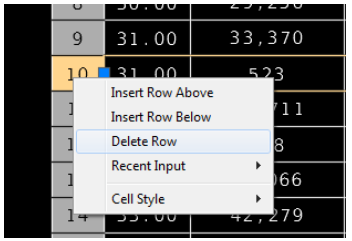
After Defining the Basin the Stage Storage Dialog has contour data ready to either insert into the drawing as an AutoCAD Table or you can save the file for importing into an analysis program





When you insert the Table into the drawing make sure your current layer is set to Tables_dp.

If the Table contains data that is duplicated or has 0's in it you can modify the table like any other AutoCAD table, simply select the desired cell > Right Click > Delete Row.



STAGE STORAGE TABLE						
ELEV	AREA (sq. ft.)	DEPTH (ft)	AVG END INC. VOL. (cu. ft.)	AVG END TOTAL VOL. (cu. ft.)	CONIC INC. VOL. (cu. ft.)	CONIC TOTAL VOL. (cu. ft.)
25.00	12,090	N/A	N/A	0	N/A	0
26.00	15,069	1.00	13579	13579	13552	13552
27.00	18,275	1.00	16672	30251	16646	30198
28.00	21,708	1.00	19992	50243	19967	50165
29.00	25,368	1.00	23538	73781	23515	73680
30.00	29,256	1.00	27312	101093	27289	100969
31.00	33,370	1.00	31313	132406	31290	132259
32.00	37,711	1.00	19117	151523	14225	146484
33.00	42,279	1.00	29172	180695	28136	174620
34.00	48,745	1.00	51749	232444	51720	226340

The Finished Stage Storage Table

Tip: The Table is static, meaning if your pond changes you will have to recreate the Table.

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